

NASA TECH BRIEF



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Liquid Crystals Detect Voids in Fiberglass Laminates

The problem:

To detect voids or poor bond lines in fiberglass laminates by nondestructive testing methods. The presence of internal voids or poor bonding of fiberglass laminates is unacceptable in aerospace applications. Present inspection methods have either low void detection reliability or are somewhat primitive and time consuming. An improved test method was needed to more accurately describe void sizes and provide desired assurance of product quality.

The solution:

A thin coating of liquid crystal solution applied by spray or brush to the test article surface, will, when heated, indicate the exact location of defects by differences in color.

How it's done:

Paint the surface to be tested with a dull black, water soluble, solvent resistant paint. Over this, apply by spray or brush a thin coating of liquid crystal solution. Allow the solvent to evaporate and heat the test panel.

As heating takes place, the solution rapidly covers the color spectrum; changing first to red, then to yellow, green, blue, violet, and, as heating continues, back to colorless. On cooling, the color sequence occurs in reverse order. Differences in heat transmission in materials due to voids produce differences in surface temperature causing differences in liquid crystal color which outline internal voids. Color photographs may be taken for permanent records.

Notes:

1. Liquid crystals, which are commercially available, have the mobility of liquids and the optical properties of solids. These materials exhibit visible color change with as little as 3°C temperature differential, and at specific temperatures always attain the same color for a given liquid crystal material composition.
2. The test surface must be darkened because the liquid crystals scatter light rather than absorb it. However, when testing a large surface area, a black mylar film may be used instead of the black water soluble paint.
3. These liquid crystals can also be used for visual checking of shorts and open circuits in electronic components.
4. Inquiries concerning this innovation may be directed to:

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Reference: B67-10286

or to

New Technology Representative
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(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

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